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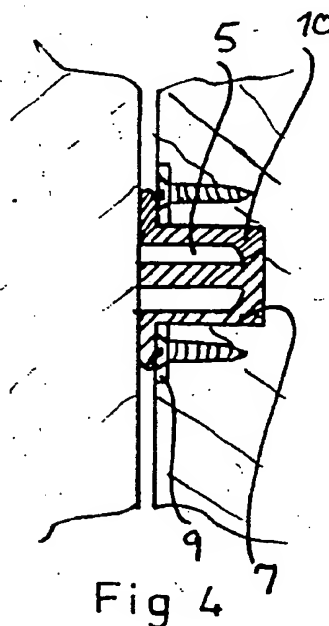
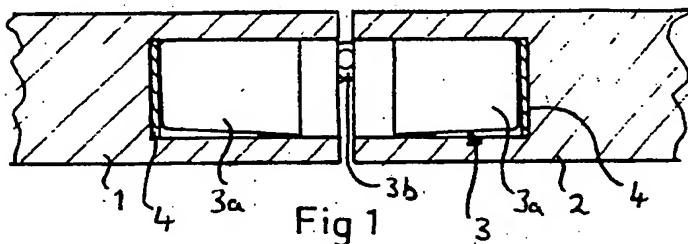
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Pyroswing concealed door closer, Product Information  
and application sheet 7, April 1986. Mann McGowan  
Fabrications Limited, Unit 4, Brook Trading Estate,  
Deadbrook Lane, Aldershot, Hants

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UK CL (Edition L ) E1J JGK JGN JGS  
INT CL<sup>5</sup> E06B  
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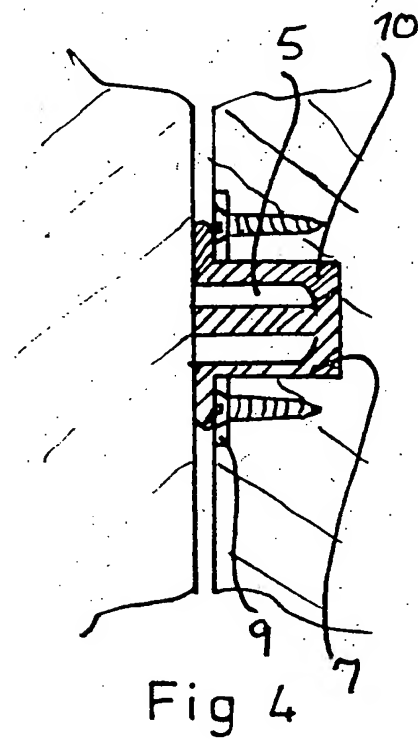
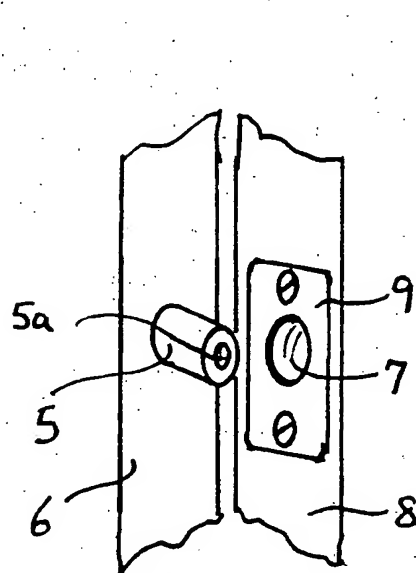
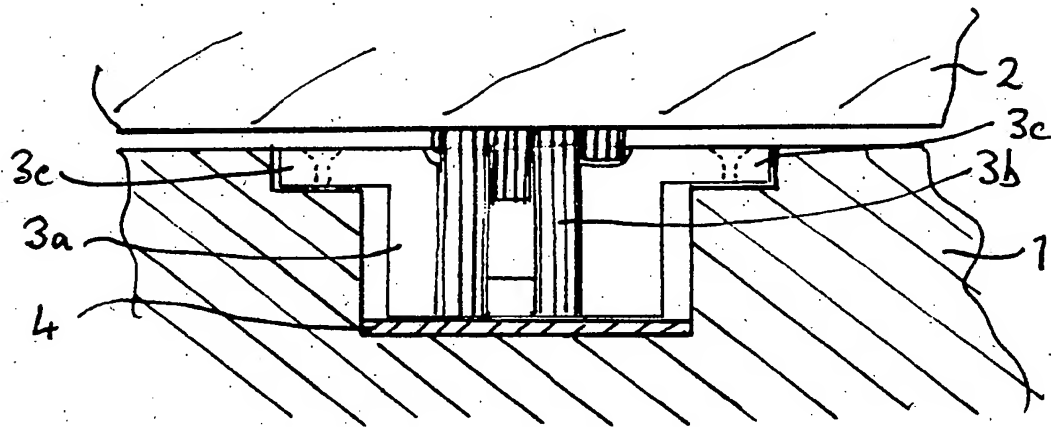
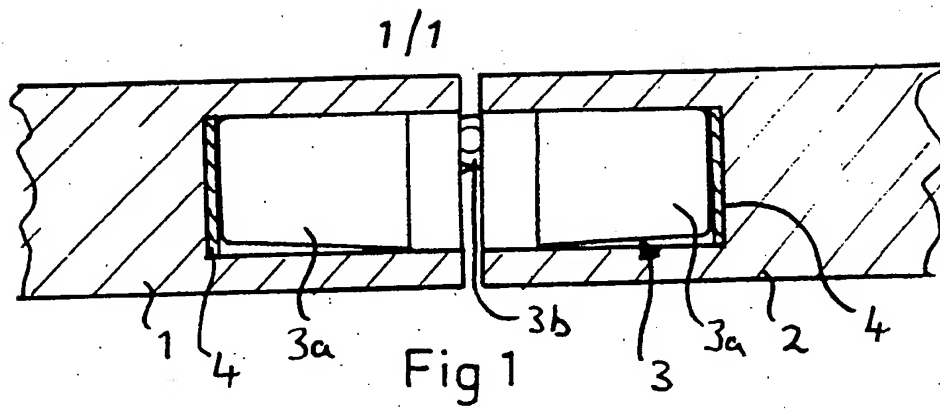
## (54) Fire door

(57) A fire door has a concealed or semi-concealed hinge mechanism (3) mounted in a recess in the end of the door (1) and/or in the door stile (2), the or each recess containing a penetrative intumescent material (4) arranged to expand to maintain the integrity of the connection between the door and/or door stile and the hinge in the event of a fire on one side of the door.

The fire door may have at least one hinge bolt (5) extending from the end of the door or from the door stile and entering into a corresponding recess (7) in the opposed surface when the door is in its closed position, the hinge bolt and or the recess being provided with a penetrative intumescent material (10) arranged to expand to provide a mechanical connection between the hinge bolt and the recess in the event of fire on one side of the door.



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FIRE DOORField of the Invention

This invention relates to a fire door, and especially, but not exclusively, to a fire door of the type having concealed or semi-concealed hinges.

Background to the Invention

The purpose of a fire door is to prevent the spread of fire by providing, when closed, a fire-resistant barrier. Concealed or semi-concealed door hinges, for example of the type disclosed in US Patent Specifications Nos 1 984 032 and 2 021 702, are useful in fire doors, since the heat-conductive components of the hinge are contained within the material of the door, usually wood, and are not exposed directly to the fire. This can delay failure of the door. Such hinges typically involve a number of sliding pivots, and therefore require a relatively complex shape for the main supporting members. This shape is relatively costly to produce in high melting-point materials such as steel, because precision machining is required. It is therefore convenient to manufacture such components by die casting relatively low melting point materials such as zinc. Further, to ensure smooth movement of the sliding components, particularly for use with large and heavy doors, lubricating plastics inserts can also be used, for example plastics links impregnated with molybdenum disulphide.

While the performance of such hinges in fire doors has been found to be satisfactory in standard 30 minute fire

tests, the thickness of the material overlying the metal of the hinges within the door is necessarily less than the overall thickness of the door, and so the fire resistance is potentially lower, heat penetrating the hinge possibly causing melting of some components, with the risk of failure of the support of the door. Although such failure is very unlikely during the normal 30-minute endurance required for standard fire doors, the risk of initial failure of such a fire door at the hinges at any stage is further reduced in accordance with the present invention.

#### Summary of the Invention

One aspect of the invention provides a fire door having a concealed or semi-concealed hinge mechanism mounted in a recess in the end of the door and/or in the door stile, the or each recess containing a penetrative intumescent material arranged to expand to maintain the integrity of the connection between the door and/or door stile and the hinge in the event of a fire on one side of the door.

The invention is particularly applicable where the hinge mechanism comprises materials whose structural integrity is reduced at fire temperatures, for example components formed of zinc and components formed of plastics materials.

The hinge mechanism may be provided with at least one recess therein filled with said intumescent material.

Another aspect of the invention provides a fire door having at least one hinge bolt extending from the end of

the door or from the door stile and entering into a corresponding recess in the opposed surface when the door is in its closed position, the hinge bolt and or the recess being provided with a penetrative intumescent material  
5 arranged to expand to provide a mechanical connection between the hinge bolt and the recess in the event of fire on one side of the door.

The intumescent material is suitably a graphite-filled intumescent material.

10 The hinge bolts may be used with concealed or semi-concealed hinges, or with conventional butt hinges, permitting the use of hinges formed of materials such as plastics or low-melting point metals which will melt before a fire causes significant damage to the door. This avoids  
15 the danger of, for example, steel or brass hinges conducting heat from the fire to the door end and thereby damaging the door more rapidly. The hinge bolts continue to hold the door in position.

It will be understood that, although reference is  
20 made throughout to a door and door stile, the fire door of either aspect of the invention may comprise a pair of mutually hinged doors.

#### Brief Description of the Drawings

In the drawings, which illustrate exemplary embodi-  
25 ments of the invention:

Figure 1 is a part-sectional plan view through a pair of hinged doors in accordance with one aspect of the invention;

Figure 2 Is a part-sectioned elevation corresponding to Figure 1;

Figure 3 is a perspective view of a door and stile in accordance with another aspect of the invention; and

Figure 4 is a part-sectional elevation of a portion of the door shown in Figure 3, after the occurrence of a fire.

#### Detailed Description of the Illustrated Embodiments

Referring to Figures 1 and 2, a door 1 is hinged to a door stile 2 by means of concealed hinges 3, of which only one is shown in the Figures. The hinge 3 comprises a pair of die cast zinc body parts 3a in which are slidably mounted connecting links 3b pivoted together. The links 3b are formed of laminae of steel with pre-lubricated polyamide (e.g. "Nylon") links between. The structure of the hinges is such that they contain within them voids to permit movement of the components. The hinges are fitted into the door and stile by routing out recesses to accommodate the main part of the hinge and the fixing flanges 3c, through which screws are passed to hold the hinge in place. It is an inevitable result of the routing process that voids surround the hinge.

In order to protect the hinge in the event of a fire on one side of the door, an insert 4 of a graphite-filled intumescent material is placed in the routed recess before

the hinge is fitted. When the intumescent material becomes heated as a result of the fire, it expands substantially from its initial volume, forcing its way into and filling any voids initially present or arising as a result of any melting of hinge component materials. The material is such that the hinge body becomes completely surrounded by the expanded intumescent material, which serves not only to protect the hinge from further damage, but also to maintain the integrity of the connection between the hinge and the door, and between the hinge and the door stile, holding the door in position to resist the fire for the longest possible period of time.

Figures 3 and 4 show a form of hinge bolt 5 extending from the end face of a door 6, and having an axial bore 5a therein which is filled with a graphite-filled intumescent material. When the door is closed, the hinge bolt enters a recess 7 in the door stile 8, the recess being protected by a metal plate 9 screwed to the surrounding wood. The recess is slightly larger in diameter than the hinge bolt to facilitate its entry thereinto. In everyday use the hinge bolt serves its conventional purpose of resisting forcing of the door.

Figure 4 shows the effect of fire heating the hinge bolt and therefore the intumescent material therein. Only the door stile is shown sectioned; the hinge bolt extends into the door end in the conventional manner. It will be seen that the intumescent material 10 has expanded to fill

the recess 7 completely, forming a mechanical connection between the hinge bolt and the door stile, helping to hold the fire door in position for the longest possible time.



CLAIMS

1. A fire door having a concealed or semi-concealed hinge mechanism mounted in a recess in the end of the door and/or in the door stile, the or each recess containing a penetrative intumescent material arranged to expand to maintain the integrity of the connection between the door and/or door stile and the hinge in the event of a fire on one side of the door.

2. A fire door according to Claim 1, having at least one hinge bolt extending from the end of the door or from the door stile and entering into a corresponding recess in the opposed surface when the door is in its closed position, the hinge bolt and or the recess being provided with a penetrative intumescent material arranged to expand to provide a mechanical connection between the hinge bolt and the recess in the event of fire on one side of the door.

3. A fire door according to Claim 1 or 2, wherein the hinge mechanism comprises materials whose structural integrity is reduced at fire temperatures.

4. A fire door according to Claim 3, wherein the hinge mechanism comprises components formed of zinc.

5. A fire door according to Claim 3 or 4, wherein the hinge mechanism comprises components formed of plastics materials.

6. A fire door according to any preceding claim, wherein the hinge mechanism is provided with at least one recess therein filled with said intumescent material.

7. A fire door having at least one hinge bolt extending from the end of the door or from the door stile and entering into a corresponding recess in the opposed surface when the door is in its closed position, the hinge bolt and  
5 or the recess being provided with a penetrative intumescent material arranged to expand to provide a mechanical connection between the hinge bolt and the recess in the event of fire on one side of the door.

8. A fire door according to Claim 7, wherein the  
10 bolt has a bore therethrough opening at the free end thereof, the bore containing the intumescent material.

9. A fire door according to any preceding claim, wherein the intumescent material is a graphite-filled intumescent material.

15 10. A fire door, substantially as described with reference to, or as shown in, the drawings.

11. A hinge bolt for a fire door, the bolt having a bore therethrough opening at the free end thereof, the bore containing a penetrative intumescent material.

20 12. A hinge bolt, substantially as described with reference to, or as shown in, Figures 3 and 4 of the drawings.

**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

9. Application number

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**Relevant Technical fields**

(i) UK Cl (Edition L ) E1J: JGK, JGN, JGS

(ii) Int Cl (Edition 5 ) E06B

**Search Examiner**

JOHN ROWLATT

**Databases (see over)**

(i) UK Patent Office

(ii) ONLINE WORLD PATENTS INDEX

**Date of Search**

18 JUNE 1993

Documents considered relevant following a search in respect of claims

1-10

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2245025 A (JEBRON LTD)	1,3-6,9
X	GB 1580160 A (DIXON INTERNATIONAL)	1,3-6,9
X	Pyroswing concealed door closer Product information & application sheet 7, April 1986 Mann McGowan Fabrications Limited, Unit 4, Brook Trading Estate, Deadbrook Lane, Aldershot, Hants	1,3-6,9

Category	Identity of document and relevant passages 10	Relevant to claim(s)

### Categories of documents

**X:** Document indicating lack of novelty or of inventive step.

**Y:** Document indicating lack of inventive step if combined with one or more other documents of the same category.

**A:** Document indicating technological background and/or state of the art.

**P:** Document published on or after the declared priority date but before the filing date of the present application.

**E:** Patent document published on or after, but with priority date earlier than, the filing date of the present application.

**&:** Member of the same patent family, corresponding document.

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